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ARBORETUM BULLETIN

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SUMMER, 1973

PRESIDENT'S MESSAGE

Gordon D. Marckworth who has served as editor of the Bulletin since spring of 1965, has stepped down. Mrs. Joseph Butler is our new editor.

The Arboretum Foundation is sincerely grateful for the contributions that Dean Marckworth has made to the Arboretum, not only in serving as editor of the Bulletin but as editor of the book, *THE LONG ROAD TRAVELLED*, by Henry Schmitz, and as a member of the Board of Directors. We are pleased that Dean Marckworth will continue to work with the Editorial Board as editor emeritus and that we can enjoy his contributions to the Bulletin in the future as we have benefited from his leadership in the past. We are confident that the Editorial Board under Mrs. Butler's leadership will continue to give us the fine Bulletin which we have come to expect.

On another topic, this last summer, representatives from the University and the City labored hard and long to develop a lease agreement between the two which will insure a quality Arboretum for Washington Park. This lease has been reviewed by the Executive Board of the Arboretum Foundation and found quite satisfactory, with perhaps the exception of the number of hours the Arboretum will be open and this is still under discussion. Also, we feel that the lease contains the necessary safeguards for the public interest and involvement. The Foundation, made up of a segment of the public sincerely interested in the Arboretum, would be the first to speak out if we felt that this lease did not protect the public's interest.

We hope that by the time this Bulletin reaches you, the lease will be signed between the principals involved and that the University, the Foundation, and other interested parties can go ahead with the continued development of the Arboretum and the kind of program that will benefit everyone.

John A. Putnam

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THE UNIVERSITY OF WASHINGTON
Arboretum bulletin

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TABLE OF CONTENTS

		Inside Front Cover
President's Message	John Putnam	
Allelopathy: Chemical Antipathies Among Plants	Roger del Moral	2
Master Gardening: A Challenge With Rewards	David Gibby, Sharon Collman	6
Alaskan Wildflowers for Pacific Northwest Gardens	Maxcine Williams	8
Arboretum Classes		16
New Members		16
The Arboretum Answers	J. A. Witt	17
Arboretum Spotlight - *Styrax obassia*	B. O. Mulligan	18
National Arboretum Appoints New Director	Rosamond P. Engle	19
Favorites - *Enkianthus campanulatus*	Ed Hume	21
Unit Conversations	Phyllis Morgan	23
Book Reviews		24

COVER PHOTO: *Styrax obassia*
Photo: E. F. Marten

Fig. 1: Pattern of herb growth inhibition associated with *Salvia leucophylla* and produced by volatile terpenes including cineole and camphor. The region from A to B is the bare zone; the region from B to C is the inhibition zone; and the region beyond C is normal annual grassland. *Photo: Courtesy of and copywritten by Dr. C. H. Muller, Santa Barbara.*

ALLELOPATHY: Chemical Antipathies Among Plants

Roger del Moral*

Introduction

Our perception of green plants is prejudiced by the fact that we are poorly equipped to notice those activities at which plants are particularly adept. I refer to the profusion of biochemical interactions engaged in by most plants in response to a host of selective pressures. The full implications of the biochemical virtuosity of higher plants are only now beginning to be understood by biologists. In this communication, I will confine myself to a consideration of the process termed "allelopathy." Allelopathy occurs whenever one plant produces toxic chemicals at such time, in such concentrations and in such a manner as to inhibit the growth or reproduction of another plant.

Being sedentary, plants are quite incapable of escaping their enemies in space. Thus either they must be able to defend themselves or escape in time. The obvious defense mechanisms such as thorns or stinging hairs are well known, but of more general importance to plants are "chemical thorns" which suppress competitors and repel or deter potential predators. What follows introduces the subject of the suppression of competitors, i.e. allelopathy. A subsequent report will deal with plant-

*Dr. del Moral, Assistant Professor of Botany, University of Washington, has authored numerous papers concerned with the biochemical interactions among plants and is currently interested in the chemical aspects of plant-herbivore interactions.

herbivore interactions. This report is offered in the hope that it will increase the reader's awareness of plants as dynamic organisms.

Allelopathic Mechanisms

Though it is undoubtedly important to ecological processes, the very existence of allelopathy has been bitterly contested. A. P. deCandolle (1832) suggested that failures of certain crop rotations were due to poisons left by crop residues, but this view, though substantially correct, was discredited by Liebig (Bonner, 1950) who showed that fertilization alleviated the effects of allelopathy. Liebig made the incorrect conclusion that any phenomenon overcome by fertilization was necessarily one of nutrient deficiency. Thus for over 80 years, all cases that ultimately proved to involve allelopathy were treated as forms of competition for nutrients. Though scattered workers demonstrated the necessity and efficacy of allelopathic processes in several situations, they were hampered by their inability to detect or identify toxic organic chemicals under natural environmental conditions. Only with the application of refined analytical methods to the problem has allelopathy become a generally accepted phenomenon with many instances documented.

Undoubtedly the most spectacular, and historically very important, case of allelopathy involves the purple sage (*Salvia leucophylla*). This highly aromatic mint forms dense thickets in the coastal sage vegetation of southern California. Where such thickets abut annual grasslands, spectacular vegetative patterns occur (Fig. 1). No grass survives within a 1-2 m. "bare zone." Beyond this, there is an easily discernible region in which some grasses are stunted and certain others are totally lacking. This "inhibition zone" may extend up to 10 m. under some circumstances. Muller (1966; 1969a) and his co-workers ascertained that this phenomenon was due to volatile terpenes, the same chemicals responsible for the characteristic odor of sage. These terpenes, among them camphor and cineole, were shown to be concentrated in the dry soil after volatilization from the shrub. Stored on the clay sized particles through the dry summer, the terpenes effectively prevent germination in the bare zone when winter rains finally initiate the growing season (Muller and del Moral, 1966). By means of gas chromatography, the chemicals were traced from *Salvia* to the air and hence to the soil. A long series of experiments (Muller, et al., 1964; Muller and del Moral, 1966; Muller, 1970) demonstrated that terpenes were essential to the initiation and maintenance of the pattern, but that the pattern was accentuated during dry years and that the depradations of small mammals and birds further intensified the pattern (Muller and del Moral, 1971).

Less spectacular, but of more general occurrence, are the effects of water soluble compounds. *Eucalyptus globulus* (Tasmanian blue gum), as well as many other eucalypts, produces total annihilation of herbaceous vegetation beneath its crown when grown outside of Australia. Nursery men in California routinely commented that eucalyptus "poisoned" the soil, while most ecologists assumed that it "outcompeted" its herbaceous associates for water, nutrients, or light. Studies I undertook between 1965 and 1967 showed that the nurserymen were correct (del Moral and Muller, 1969).

Eucalyptus and many other woody species (e.g. *Adenostoma fasciculatum* and *Sequoia sempervirens*) are capable of intercepting natural fog and producing localized "fog drip" beneath the canopy. This mechanism not only improves the moisture status but also transfers water soluble phenolic compounds to the soil where, if conditions are suitable, bare zones develop. Gallic acid and chlorogenic acid, in addition to various tannins, are common constituents of such drip from *Eucalyptus*. The evidence that such drip can produce bare zones is substantial. Drip collected in funnels contains quantities of toxins sufficient to inhibit seeds grown in bioassays. Trees producing drip, but from which the litter was periodically removed, maintain spectacular bare zones. No pattern develops in similarly maintained eucalypts which, due to local obstructions, do not produce drip. Trenching to remove competitive effects does not alleviate the pattern significantly. Finally, no pattern develops on soils that do not concentrate the toxins.

The leaf litter on many woody species con-

tains innumerable organic compounds collectively termed tannins and such litter is the most abundant source of allelopathic compounds. These tannins are generated as a consequence of the plants' metabolic activities and, being toxic, are sequestered in vacuoles or in intercellular free space. Tannins accumulate with age, and senescent leaves are rich in tannins. While such chemicals may deter feeding by insects, it is probable that tannins are a convenient means of sequestering otherwise autotoxic chemicals (Muller, 1969b). Litter is easily leached by rain, and in the early stages of decomposition, large quantities of toxins are transferred to the soil. Under suitable conditions, seedling germination is effectively inhibited. Oaks (*Quercus* spp.), *Eucalyptus* (Fig. 2), pines (*Pinus* spp.), walnuts (*Juglans nigra*), red cedar (*Thuja plicata*), and madrone (*Arbutus menziesii*) (del Moral and Cates, 1971) are but a few species known to be rich in leaf litter tannins capable of allelopathic effects. Decaying straw of many grasses has a similar effect, though the chemistry does not involve tannins (Holm, 1971).

One last source of growth inhibitor remains. Roots may actively secrete or exude many substances, among them chemicals with phytotoxic properties (Roviera, 1971). Decomposing roots may also produce toxins. The soil microflora may co-opt harmless substrates and produce toxic substances, or may convert one phytotoxin into another. We know very little about the chemical interactions in soil except that such interactions can and do lead to spectacular and economically important cases of inhibition. Peach trees produce inhibitory compounds that render the soil unfit for the growth of young peach trees. This results in the infamous "peach replant problem" (Börner, 1960). Old orchards must be replanted to other tree crops in rotation.

Rhizosphere ecology in general, and phytotoxicity due to the roots of higher plants in particular is the least understood area of allelopathic research. It is likely that, once the proper analytical tools are developed, the mutual effects of plants and their microflora will become better known and provide us with many examples of intriguing biological interactions.

Evolutionary Considerations

Allelopathic processes are contributory to many ecological processes and are no less important as ecological factors than nutrients or water (Whittaker, 1970). They have been implicated in studies of succession, productivity, diversity, community structure, plant distribution, and others. However, the most interesting questions revolve about the evolution of this process.

Ecology is plagued with oversimplified theories and the study of the evolution of allelopathy is a prime example. Plants are organisms whose perceptual abilities are in the chemical arena and there is no reason to believe that any single evolutionary pressure has resulted in the wealth of chemical diversity for which plants are justly renowned. There is no question that some allelopathic compounds, having arisen by mutation, were initially selected for under pressure from herbivores, especially insects. Absinthim and other alka-

Fig. 2: Leaf litter of eucalyptus contains toxins with allelopathic effects which inhibit seedling germination.

loids are probably in this category. Most alkaloids are probably entirely concerned with anti-herbivore defense and have nothing to do with allelopathy. Other allelopathic chemicals may have originally had metabolic functions which are no longer employed, or which are done more efficiently by other chemicals. Chlorogenic acid is a "jack-of-all-trades" chemical which can regulate growth (Sondheimer, 1964), inhibit pathogens (Farkas and Kraly, 1962), produce allelopathic results in higher plants and nitrogen fixing bacteria (Wilson and Rice, 1968), and, perhaps, protect plants from harmful ultraviolet radiation (del Moral, 1972). And some allelopathic chemicals are, like tannins, waste products that have the bonus of deterring some predators and suppressing competitors.

It is not likely that allelopathic chemicals arose directly under selective pressures from competitors. Such selective pressure generally results in such adaptations as more efficient growth or tolerance for more extreme environmental conditions. It is more likely that natural selection pressures due to herbivores, pathogens, climatic constraints, and the necessity to deal efficiently with metabolic wastes results in the increased concentration of particular toxic chemicals. Those that build to large concentrations in the plant to meet some need not associated with allelopathy *may* become allelopathic if ecological conditions are propitious. Where strongly seasonal climate combines with the production of large quantities of toxins under conditions conducive to their concentration in the environment, obvious allelopathic phenomena can occur. However, the process is operational in any climate, manifesting itself subtly in more benign climates.

A Concluding Remark

Allelopathy is only one aspect of plant life involving organic chemicals. Strongly allelopathic species dominate their associates and improve their competitive position, yet their chemical dominance depends upon a delicate balance of many ecological processes. A complete understanding of any allelopathic process necessitates a thorough knowledge of ecological interactions in general. Thus the study of allelopathy is an excellent way for anyone to begin a serious study of plant ecology.

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Dr. Bernard Wesenberg, Dr. David Gibby and Dr. Henry Taber answer questions at a plant clinic.

Master Gardening: A Challenge with Rewards

*David Gibby and Sharon Collman**

In September, 1972, Washington State University Extension Service began an innovative and exciting new pilot program. The basic idea was to train experienced gardeners into master gardeners, problem solvers and place them in shopping centers and other convenient locations where they could help others with their gardening problems.

The Smith Lever Act which created the cooperative Extension Service in 1914, gave the Land Grant Colleges and Universities the responsibility of diffusing among the people of the various states, useful and practical information on subjects relating to agriculture and home economics. The value of the Extension Service program has been demonstrated repeatedly since that time. One of the greatest challenges of the Extension Service system is in providing service to the population centers of the country. The ever increasing growth of our suburban centers has served to increase the acute nature of this challenge.

The Master Gardener program has the capability of becoming an important tool in the Extension Service system by providing a good method of distributing useful information to gardeners and becoming an important resource to the gardener with the problem. The entire program and its success rests upon the enthusiasm and expertise of the volunteer Master Gardener. He or she is, after all, the person on the firing line—the person that must have the answer. Where do these people come from? What is their background and experience? What kind of training have they received and what is their motivation in devoting a goodly part of their time to this public service?

Recruits were screened from hundreds of applications in the fall of 1972. Persons were

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*David D. Gibby is the Area Extension Agent for King and Pierce Counties; Sharon Collman is the Assistant Extension Agent. The service is provided in cooperation with Washington State University and the U.S. Department of Agriculture.

selected for the program depending upon their background and their willingness to serve in the Master Gardener Clinic. Classes were held in the spring of 1973 and these persons were provided with a broad background in plant problem solving from a number of specialists in the WSU Extension Service. Areas covered in the training included general botany and plant physiology, soils and fertilizers, turf problems, basic entomology and insect control, concerns in growing vegetables and fruits, ornamentals, plant pathology or plant disease control, weeds and weed control and concerns of pesticides, their use and misuse and laws concerning them.

At the conclusion of this training the Master Gardeners received a rigorous state examination to allow them to act as Master Gardener Public Pest Control Consultants. Aside from the obvious value of this training and experience, the motives of the Master Gardeners are unselfish. While it is true that their expertise in gardening will be unquestionably improved by participation in the clinics, the program is demanding. They must be willing to sacrifice many hours in public service. It requires a sense of duty to the community, love of gardening and a desire to share their knowledge.

The operation of the program is simple. Public-service-minded shopping centers are approached and informed of the program allowing Master Gardeners to be stationed there. Scheduled times are published to make the public aware of the new service available to them and inviting them to bring specimens of their plant problems to the clinic for solution. A back up service is provided for the few questions unanswerable at the clinics. Problem specimens are mailed to specialists and diagnosed in the laboratory. The diagnosis is then sent directly to the individual who brought in the problem.

The program has been working. Thousands of people have thus far visited clinics in King and Pierce County, and to date, 95% of the problems submitted have received on the spot diagnosis at the clinic—a tribute to the Master Gardeners.

Where will the program go from here? This initial success leads us to believe that the program will be adopted in other areas of the country. It has proven itself not only of great interest to the general public, but also of interest to the news media. KOMO TV carries, as a regular feature in its Friday morning news, spot reports on the Master Gardener program. A number of newspapers carry frequent articles concerning the program. The activities of the Master Gardeners have even, in some cases, been expanded—with Master Gardeners giving gardening advice and problem solving information to the public via television and newspapers. Master Gardeners have been requested to participate in extracurricular events such as the King County Fair (as judges and problem solvers) and a community plant swap and teach in.

To sum up the Master Gardener program and its success—the program works to help people with gardening problems by utilizing the resources of Washington State University Extension Service, the dedication of qualified Master Gardeners and the willingness of shopping centers to provide their facilities.

The response of the general public to the Master Gardener clinic will be the ultimate gauge of the program's success. ♠

The Master Garden Clinic program described above is presently a seasonal one and therefore, inactive until Spring, 1974. However, organizations or groups sponsoring garden activities may request the services of the Master Gardeners and arrangements can be made to provide a clinic in connection with the programmed activity. Information can be obtained from the King County Extension Agent. Applications for the spring training session of Master Gardeners are now being accepted. Persons wishing to participate are invited to contact their County Extension Agent.

Ranunculus cooleyae *Photo: Maxcine Williams*

Alaskan Wildflowers for Pacific Northwest Gardens

*MAXCINE WILLIAMS**

Northwest gardeners, like gardeners everywhere, like to try something new once in a while. It might be a new variety of an old favorite, glowingly described and pictured in a seed catalog; or a plant bought at a plant sale; or an exchange with a neighbor; or maybe seeds or plants from another country or another state.

A few Northwest gardeners have tried several wild flowers from Alaska. I will mention those I know of and suggest a number of others that might live in the Pacific Northwest. It might be a problem to get them as I know of no one actively engaged in collecting Alaskan wild flowers.

For those with rock gardens the dwarf azalea *(Loiseleuria procumbens)* has proven a nice addition. It makes flat mats of tiny evergreen leaves topped with pink flowers about the size of a match head. There is a white form too, although not common. Its leaves are a paler green.

Alaska has many saxifrages. Two that might be good rock garden plants are *Saxifraga bronchialis ssp. funstonii* and *Saxifraga hirculus.* The first is a cushion plant with white to cream colored flowers on two inch stems. The inner surface of the petals is usually sprinkled with yellow or orange dots. The latter species has deep yellow flowers on two to five inch leafy stems with a basal cluster of strap shaped or linear leaves. The dwarf bluebell (*Campanula lasiocarpa*) would be a nice companion for this saxifrage. Its large blue bells have a darker stripe down the center of each petal.

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*Mrs. Williams, a long-time resident of Juneau, Alaska and student of the flora of that country, now resides in Eugene, Oregon and spends her summers in Alaska collecting.

Moss pink *(Silene acaulis)*, which has been used successfully, makes a cushion of light green leaves that is covered with bright pink flowers in spring. Dr. Hulten, the noted Swedish botanist, called this plant one of the most striking on Alaska mountains and tundra. Rock jasmine *(Androsace chamaejasme ssp. lehmanniana)* makes a nice low, creeping rock plant. Its rosettes of basal leaves have ciliate margins and the flowers are white with a yellow eye. Sometimes the "eye" is orange or pinkish and spills onto the petals giving them a rather rakish air! It has a pleasing fragrance. A prostrate milk vetch *(Astragalus nutzotinensis)* is found only in Alaska and adjacent Yukon Territory. It has white to pink flowers (Hulten says reddish purple but I have never seen that color) and its pinnate leaves are edged in rose-pink. An Anchorage gardener uses it in her rock garden where it is attractive either in bloom or in fruit with mahogany, sickle-shaped pods.

A dwarf buttercup *(Ranunculus cooleyae)* that sometimes comes up through the snow, has many strap-shaped petals and roundish, three-cleft, toothed basal leaves. It was discovered near Juneau in 1891 by Miss Grace E. Cooley, a botanist from the East, and later named in her honor. She found it in a ravine in Gold Creek Basin near Juneau but it is usually found in meadows above timberline. It blooms early and is a nice contrast to purple crocus. So far it has only been found along the coast from Prince William Sound to the Olympic Mountains of Washington. A pretty little monkshood *(Aconitum delphini-folium ssp. paradoxum)* from the Bering Sea-Brooks Range area has stayed dwarf in an Anchorage garden. If it would stay low growing down here, it would be a nice rock garden plant. A gay companion (although one that might pop up somewhere else) would be the yellow, dwarf *Anemone richardsonii.* For a different leaf form, in a dwarf plant, the iris-like leaves of *Tofieldia coccinea* make neat little clumps. The tiny, creamy-yellow flowers are in a tight raceme at first but loosen up as the flower ages. The fruit is often red tipped. *Tofieldia pusilla* has smaller flower heads but grows a little taller.

Two members of the mustard family with flowers that vary from white through pinks, lavenders and purples, have garden possibilities. *Cardamine purpurea* can be found

Silene acaulis *Photo: Maxcine Williams*

in wet meadows, tundra or dry rocky hillsides. Its leaves are mostly basal, lyrate-pinnate, ending in a short, broad lobe. One draw-back is that it also has some poor colors. This is also true of *Parry nudicaulis* which has a further drawback for a plant collector in its long tap root. One would have to get small plants, if they could be found, or have a knowledgeable Alaskan collect seed, and I know of very few of them. Its good colors are bright pink or lavender and it is a much more showy plant than the cardamine. A form which has very large flowers has been described by Dr. Hulten as *var. grandiflora.*

A very early violet *(Viola selkirkii)* is found in scattered locations in Alaska. It has bloomed as early as April 26th near Juneau, but May is its usual waking-up time there and June farhter north. After it blooms it is hidden by later vegetation so is very hard to find when not in bloom. Its flowers vary from pale to deep violet with a white inner face and the spur is thick. It produces cleistogamous flowers.

An open-faced pyrola *(Pyrola grandiflora)* meets the Arctic Ocean from Siberia to Greenland and south in Alaska to the Kenai Peninsula. Neat, roundish, evergreen basal leaves top a slender rhizome. The large white or pale pink flowers are on stems that vary from almost stemless in the high arctic to six-eight inches in its southern range. Some Alaskan gardeners have used it. It has a faint fragrance.

Alaska has several heathers. Alaska moss heather *(Cassiope stelleriana)* is found along the coast from about Unimak Island, into McKinley Park, and east and south to Vancouver Island with a few isolated spots in Washington and Oregon. This creeper has white, open bells and red calyx. The short, stiff, needle-like leaves look like a tiny bottle brush. *Cassiope lycopodioides* is more or less a creeper with thin branches that are often dead looking until the tip ends. It is not as attractive a plant as *C. stelleriana* or *C. mertensiana* but it does bloom more profusely and is interesting to those collecting heathers.

Two much more attractive sub-shrubs are *Diapensia lapponica ssp. obovata* and *Dryas octopetala* (also *D. integrifolia*). Diapensia makes a stiff mat of tiny evergreen leaves and its large white, almost stemless flowers often cover the whole plant. Sometimes it is so abundant that, at a distance, it appears to be patches of snow. Dryas can also be this abundant but its white flowers are on one to three inch stems that move with every passing breeze. The two Dryas species hybridize when they meet and cause confusion amongst botanists. Dryas has been grown successfully down here.

A little gem from the western Aleutians is *Veronica grandiflora.* It is well named as its dark blue or violet-blue flowers are about one half inch across, making it the largest flowering veronica in Alaska. The flower stems are bare and arise above more or less basal, hairy leaves. Its long, exserted, stiff stamens and pistil are outstretched downward like bristles, giving it a Fu Manchu appearance! It increases by underground runners. Several Anchorage gardens have it and it has proved very adaptable to a rock garden.

Alaska has some beautiful poppies, some with very restricted range. The lovely pink to apricot poppy *(Papaver alboroseum)* has been found only in a few places on Kenai Peninsula and nearby Portage Glacier flats. Anchorage gardeners use it and it self-sows freely and blooms for a long time. It is not an erect plant but is more or less decumbent, lifting its flowers up a few inches from the rocks. The only other place it is found is the Kamchatka Peninsula to the northern Kurile Islands. It has been grown in Washington.

I can't help mentioning two other poppies. *Papaver walpolei* was first collected at Nome by a Mr. Walpole and it seems to be confined to the Seward Peninsula and East Cape Siberia. At Nome the flowers are yellow but in other areas it is often white with a yellow center. The leaves are distinctive, being tightly packed with the margins rolled under. It grows six to eight inches tall. The Alaska poppy *(P. alaskanum)* is found from Mt. McKinley Park south and west (and in one corner of Yukon Territory) through the Aleutians and islands of the Bering Sea. It is a yellow poppy described as low growing, but on St. Paul Island it is at least 12 inches tall.

Several daisies of low to medium height might be worth trying. *Chrysanthemum*

integrifolium has white flowers and is found across the arctic in Alaska, Canada and the tip of Siberia. It extends south to Mt. McKinley Park. The basal leaves are short and linear, the flower stem is almost leafless, topped with a single blossom. It grows singly or in clumps six to eight inches tall.

Arnica lessingii is a yellow daisy with a nodding head, at least when it first comes out. It can grow singly from a basal cluster of leaves but along some of Alaska's highways it is often in clumps about 12 inches tall. It has a look-alike in *A. frigida* but this flower raises its head and has yellow anthers while the nodding one (I call it Shy Maid) has dark purple, almost black, anthers.

There are two dwarf erigerons that have proved good in Alaskan gardens. *Erigeron humilis* is more widespread being found in the western states also. Its involucral bracts are thickly covered with purplish hairs and the petals are usually short. *E. purpuratus* is confined to Alaska and adjacent Yukon Territory. It also has purplish hairs on the involucral bracts but its petals are longer and the flower is open faced. It likes roadside rocks or other rocky places. Leaves of both species are more or less hairy.

Some gardeners here have found a few dwarf Alaska willows nice additions to a rock garden. *Salix rotundifolia* has very small leaves and likes partial shade and plenty of water. Two other dwarfs are *S. reticulata* and *S. phlebophylla.* Only *S. reticulata* is found in a few places in continental U.S.

There are several taller flowers that might like the Pacific Northwest. Alaska's blue geranium *(G. erianthum)* is used quite extensively in Alaska and has been grown in Washington. It can reach 20 inches although usually lower. The lavender-blue flowers have dark red, feathery lines running almost to the edges of the petals. It blooms a long time. It could be used in a perennial border but would bloom best if not crowded. It makes a nice specimen plant.

Narcissum-flowered anemone *(A. narcissiflora* with several subspecies) in favorable locations will make huge plants. The G.I.'s on the Aleutians in WWII called this abundant flower Narcissus, because of its pure white petals. It would need room and might be happiest near the sea.

A penstemon *(P. gormanii)* confined to eastern Alaska and adjacent Canada has a closely related species in the "Lower 48," *P. eriantherus.* The Alaskan species has large, wide-throated flowers that vary in color,

Anemone narcissiflora *Photo: Maxcine Williams*

sometimes even on the same flower. The throat is usually white but the rest of the blossom can be lavender, blue, violet or pink, or a combination of these colors. In Yukon Territory, especially, I have seen all these color variations. Along the road in very dry situations it is only four or five inches tall but in interior Alaska it can be two feet tall. It prefers sandy or rocky soil.

Ross geum *(G. rossii)* is not found outside Alaska, adjacent Canada and coastal eastern Siberia although it has a close relative in the Rockies. It is a handsome plant with pinnate leaves and large yellow flowers. In alpine situations it is low growing but at lower elevations it can make large clumps about 12 inches tall.

The Kamchatka rhododendron *(R. camtschaticum)* has been grown successfully by several Northwest gardeners but it merits wider use. It has been divided into two sub-species; the arctic form on Seward Peninsula is *ssp. glandulosum* and grows only a few inches high. In a good year it will carpet the top of Anvil Mountain behind Nome with its rose-purple flowers. On Kodiak Island *(ssp. camtschaticum)* it is sometimes a foot tall. I have been told there is a red flowered form and have seen a white one.

The flowers of *Iris setosa* are very similar to the cultivated Japanese iris and have been used down here.

It seems everyone wants orchids! My Anchorage friends, who sometimes get inquiries about Alaskan wild flowers, say that orchids are most wanted. Some people don't even offer to pay air mail postage, nor travel expenses to go get them, package them and mail them. They do not grow in people's back yards, and if Alaskans do know where they grow, it is at least a hundred mile trip to get them. Summer is Alaskan's busy time, especially if they have a garden, so they don't have time to go flower hunting for someone else. The milk-white orchid (*Cypripedium passerinum*) is more widespread but the rose-purple one (*C. guttatum*) is most in demand. On Kodiak Island and the Aleutians this latter one shows much color variation. The base color of the pouch is often pale yellow instead of white and the blotches are a purplish-brown. Both kinds have underground runners. I have, for a price, sent some and other plants to growers and collectors a few times, but only if I were where they were.

There are many more that *might* grow in the Pacific Northwest. I will list a few with brief descriptions.

Delphinium brachycentrum is a beautiful, lively blue in the Bering Sea area but is more lavender in Mt. McKinley Park. It has a restricted range. A dwarf corydalis *(C. pauciflora)* is blue to lavender, about four to six inches tall and blooms early. It likes to hide in brush or tall grass, usually by water. *Potentilla biflora* has yellow flowers and leaves divided into many linear segments. It makes big patches on Anvil Mountain near Nome and in the Brooks Range. *Geum pentapetalum* is found in the middle Aleutians and southern Kamachatka to Japan. It has white flowers and pinnate leaves. It was used in a Juneau garden once and was much prettier than in the wild state. Three cushion type oxytrope have been used in Anchorage gardens: *Oxytropis nigrescens* (Siberia, Alaska and Yukon Territory), *O. scammaniana* (Alaska and Yukon Territory) and *O. huddelsonii* (Alaska and Yukon Territory). None are found farther south than British Columbia and two are restricted to Alaska and adjacent Canada. All have purple flowers. A creeping astragalus (*A. polaris*) found only in Alaska, mainly the arctic coast, has rose-purple flowers and a short seed pod that is greatly inflated at maturity. A similar creeper (*S. bodinii*) is found in Canada also, but these two meet only in Mt. McKinley Park.

Douglasia ochotensis, a cushion of beautiful pink to rose flowers when in bloom, is a very early flower of the arctic, restricted to the Brooks Range, Arctic Coast to Seward Peninsula and coastal Siberia. *Polemonium boreale* is more common in Siberia but is on the Bering and Arctic Seas and northern mountains of Alaska. It grows about 12 inches tall and has lavender-blue to purplish flowers. *Synthyris borealis* is restricted to Interior Alaska and adjacent Canada. It is another early bloomer with bright blue flowers and hairy leaves. The Steese highway mountains and McKinley Park have this flower. An odd looking

plant is *Lagotis glauca*, which to me, has two distinct types of growth. In the high arctic it has thick basal leaves and the flowers are white with navy blue anthers. At Nome it is blue with a few thin leaves. I have also seen it tall and coarse in its southern range.

A bluebell *(Campanula aurita)* whose petals are cut nearly to the base, is related to *C. piperi* of the Olympic Mountains. It is especially common on some parts of the Taylor highway where it grows to about 12-15 inches tall. For grey-green foliage that more or less hugs the ground, some of the dwarf antennarias have been used in Alaska gardens. An exceptionally pretty one is *A. dioica* of the Aleutians because its leaves have a narrow white edge. *A. monocephala* is another dwarf species found over most of the State.

Rhododendron lapponicum is a shrub that can be a few inches high on the Bering Sea or two feet tall on the Alaska highway in Canada. It is fragrant and I remember one stretch of about three miles in Yukon Territory where the plant can be smelled, if not seen, if one is going too fast. It blooms in the muskeg in early June. An interesting shrub is the Copper Bush *(Cladothamnus pyrolaeflorus)* so named because of the color of its open-faced flowers. It is found in Prince William Sound area and S.E. Alaska to Saddle Mountain in northwest Oregon. It has been used in Juneau gardens.

Some Alaska primroses have been tried in Oregon and Washington but without too much success. This is too bad, as there are two or three very lovely ones.

If you go to Alaska to collect plants, please remember your good garden manners. Don't dig *all* of *any* plant, especially if it is along the road. Get off the road a bit to dig. Some of Alaska's plants are rare, such as the pink poppy, and should not be dug at all. But seeds could be collected and would probably have a better chance of survival. Of course in the Parks no collecting of any kind is allowed without a permit and then only for scientific purposes.

Some of Alaska's plants are so particular that they won't grow anywhere but in their own natural habitat. This is especially true of the Alpine forget-me-not *(Eritrichium aretiodes)* which thoughtless people have pulled from its rocky home and planted in their garden where it promptly died. So please, leave them to brighten their own corner of our Great Land. ♠

Tofieldia coccinea *Photo: Maxcine Williams*

W

Loiseleuria procumbens

Cassiope stelleriana

Photos by Maxcine Williams

Cassiope lycopodioides

LD FLOWERS OF ALASKA

Cladothamnus pyrolaeflorus

Campanula lasiocarpa

Geranium erianthum

Arboretum Classes

Arboretum Courses scheduled by the College of Forest Resources for fall quarter included both beginning and intermediate bonsai culture, birds of the arboretum, fall tours, and pruning ornamentals. Response was great and classes were quickly filled. Early registration for winter classes is advised. Information and registration blanks are available in SPECTRUM which is sent free of charge to those on the Continuing Education mailing list. To place your name on this list or to receive information for the next quarter's classes, call 543-2590.

The Arboretum Foundation is proud of its participation in helping to publish two recent books: THE LONG ROAD TRAVELLED by Henry Schmitz and FLORA OF THE PACIFIC NORTHWEST: An Illustrated Manual by C. Leo Hitchcock and Arthur Cronquist. Both would make ideal Christmas presents!

THE LONG ROAD TRAVELLED contains the only published history of our Arboretum as well as providing a personal account by an eminently well-qualified forester of the development of lumbering in the Pacific Northwest in general and the College of Forest Resources in particular. The many black and white illustrations visually enhance the book.

FLORA OF THE PACIFIC NORTHWEST has been long awaited by botanists and horticulturists. This compilation of the five-volume set, THE VASCULAR PLANTS OF THE PACIFIC NORTHWEST, will be a welcome and useful addition to any botanical library. A review appears in this issue of the BULLETIN.

Both books may be obtained through the Arboretum Foundation office or by calling 325-4510. *Do your Christmas shopping early!*

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (April 30, 1973 through July 31, 1973):

Contributing — Mr. & Mrs. David S. Bingham, Mrs. Robert S. Evans, Mrs. Yale Evans, Mrs. Harry E. Morgan. *Sustaining* — Miss Della Patch, Mrs. Ralph Smalling. *Annual* — Neil D. Adams, M.D., Miss Fermo Albertini, Douglas R. Bailey, Mrs. Velma Balut, Mrs. Richard E. Barnett, Mrs. Gerald Bernstein, Mrs. Bronko Borozan, Mrs. Charles A. Bosserman, Mrs. John Butler, Mrs. W. K. Chilcott, Mrs. Arthur Coulter, Mrs. Joy Decker, Mrs. Stanley R. Engle, Mrs. Judson F. Falknor, Mrs. Roger L. Freeman, Mrs. R. A. Friel, Mrs. Douglas W. Gant, Mrs. William Glueck, Mrs. William E. Grier, Mrs. Alvin Hagg, Mrs. William H. Hague, Mrs. John L. Halloran, Mrs. David W. Hewitt, Mrs. Maida Holzman, Mrs. Mary K. Hoyt, Mrs. Meridith R. Jones, Mrs. Morrison Jones, Mrs. Ernest A. Jonson, Mrs. David Kemle, Mrs. Martin Lawseth, Mrs. H. Warren Leitch, Joan C. Mathews, Mrs. Harold A. Neff, Mrs. Robert L. Norrie, Mrs. John Osberg, Mrs. Joe H. Palmer, Mr. & Mrs. Richard Poppe, Mrs. Seth Richards, Mrs. Kent R. Rogers, Mrs. C. W. Saar, Dorothy Singletary, Mrs. Kenneth D. Stevens, Mrs. Robert Tighe, Mrs. Frederick Tokarchek, Mrs. Richard W. Vinal, Mrs. S. J. Vukov, Mrs. Joel Wallenstrom, Mrs. James Watson, Mrs. Sylvia Wells-Henderson, Mrs. R. Jeffrey Westcott, Mrs. Estelle Wertheimer, Mrs. Stewart W. White, Mrs. Eldon J. Wicklund, Mrs. Ross P. Williams, Mrs. Rockwell P. Willson, Mrs. Robert B. Woodruff.

We are also grateful to the following members who have increased their dues to: *Supporting* — Mrs. Max Meerker, Mrs. R. J. Richardson. *Contributing* — Mrs. Martin F. Jordan, Mr. & Mrs. J. B. Wallace. *Sustaining* — Thomas J. Delendick, Mrs. Carl F. Gould, Jr., C. E. Simons, Jr. M.D., Mrs. Ray H. Tyson.

The Arboretum Answers

*J. A. WITT**

The staff reduction of the past several years has had an adverse effect on our ability to answer gardening questions. We now are referring all vegetable and fruit problems to the King County Horticultural office and houseplant questions to the Seattle Park Department conservatory at Volunteer Park.

In order to allow more time for Arboretum work we will receive telephone inquiries any time during working hours but call back answers between 12 noon and 1:00 p.m. and 4:00 p.m. and 5:00 p.m. only.

Q. My blue spruce has some funny looking cones growing at the tips of the branches. When I cut into them they seem to be full of eggs or something. What is this?

A. On blue, Engelmann or Sitka spruce these are the galls caused by the Cooley spruce gall aphid. This aphid attacks the spruce in early spring and its feeding on the new growth causes the gall. Control requires spraying in early spring just before the new growth comes out. Diazinon or Thiodan are the insecticides recommended by W.S.U.'s *Chemical Insect Control Handbook*.

Q. My garden club asked me to do a paper on flowering trees for a small garden. I've heard you have slides or films and books that garden club members can borrow.

A. We are very glad to loan our slides, but we do ask you to come to the office and pick out what you need. We are unable to supply staff to do this for you. We do not have movie films on the subject you must talk on; our only films are "Summer Cuttings" and "Pruning Practices at Brooklyn Botanic Garden." The latter is the property of the Northwest Ornamental Horticultural Society, but they are willing to have it used. Books in our library are not loaned out. They may be used in the office, and we will assist you in finding what is available if you need help.

Q. I didn't mulch my azaleas this year and I'm afraid they will get frozen if they don't have a cover over their roots. What do you recommend for this purpose?

A. We mulch regularly in the Arboretum and we've used a wide type of materials—sawdust, bark, leaves, shavings, etc., but we don't mulch to keep azalea roots from freezing. In our area mulches are used primarily for weed control, to keep soil moisture from evaporating during the dry summer months and to keep temperatures in the root zone from fluctuating as widely as do air temperatures. There is some evidence that evergreen azaleas may even be more prone to freeze injury in mulched beds. We no longer use sawdust since there are certain problems with it. At present we use shavings that have been used as stable litter because it is available to us at a very low cost.

Q. Last year we bought an *Eucalyptus* for our garden because I wanted to use its leaves in flower arrangements. We managed to get it through the winter O.K. but now its leaves are changing shape. They aren't round any more, they are sort of long and pointed. What happened?

A. Nothing abnormal happened. *Eucalyptus*, as with several other kinds of trees, have two kinds of leaves—juvenile and adult—that are very distinct from each other, at least in certain species. In order for your plant to keep producing the round or juvenile foliage you must keep pruning back the old wood to force out the new growth that produce round leaves. You can't have a tree shaped plant without having the adult leaves.

Q. What can we do about our timber bamboo that is flowering? All its leaves are turning brown and we've heard that the plants will die.

A. The timber bamboo, *Phyllostachys bambusoides* is flowering all around this area and probably elsewhere as well since it appears that these bamboos flower about every sixty years. The culms that flower die, but there seems to be some question whether or not the entire plant will die. We suggest that you increase the fertilizer and water you give the clump and hope that some new shoots will develop that may not be affected by the flowering. It may be that good seed will develop from the flowers and you might find seedlings coming up in a few years. Don't count on landscaping your garden with these, however, since bamboo seeds seem to have a very low viability.

Arboretum Spotlight

Styrax obassia

This native of Japan, Korea, Manchuria and reportedly also of eastern China is an interesting and distinctive small tree attaining about 30 feet in 20-25 years. The habit is compact and upright, making it quite suitable for smaller gardens.

It is notable especially for the size of the more or less ovate leaves, which are frequently 7 ins. long by 5 ins. wide, and may be larger than that. They are prominently veined especially on the paler lower side which is entirely covered with small branched hairs. The stout stalk is about an inch long and completely encloses the bud in its base. The margin is very irregularly toothed in the upper half.

The young shoots of the current year are green but in their second year the outer bark peels off and reveals smooth brown skin beneath which becomes darker in the third year.

The fragrant white bell-shaped flowers are produced in June on two-year old wood in the form of 5-8 inch long racemes, although the tree has to be of some size before it begins to flower. It would be advantageous to plant it 6-8 ft. below a path, if possible, so as to look into the branches when in flower. The fall color is not outstanding—a pale yellow hue.

This tree was first described by Siebold and Zuccarini in their *Flora Japonica* (1835), but not introduced until collected by Charles Maries in Hokkaido, Japan, in 1877, working for the Veitch Nursery of London, England, with whom it first flowered in 1888. It is therefore nearing the centenary of its introduction. Dr. Wyman in *Trees for American Gardens* (Macmillan, 1965) rates it as hardy in Zone 6, one zone colder than the Puget Sound region, sufficiently hardy for southeast Washington and north central Oregon. No doubt the source of seeds would have a great influence on this factor.

There are two older plantings in the Arboretum. In 1949 two plants were placed to the northwest of the Winter Garden, raised from seeds received in 1941 from an unrecorded source. These are now 30 and 24 ft. tall and flower and usually fruit regularly. The second was a plant received from the late Donald G. Graham, planted November 1950 close to the Broadmoor fence just north of Rhododendron Glen. This tree has a double stem, as does one of the others, and is now about 27 ft. in height. Both plantings are backed by native evergreen trees which serve to accentuate the flowers and foliage of the *Styrax* both in summer and fall.

Brian O. Mulligan

Dr. John L. Creech

National Arboretum Appoints New Director

ROSAMOND P. ENGLE

Dr. John L. Creech has formally left the ranks of plant exploration, which has brought him wide acclaim, becoming the third Director of the National Arboretum in Washington D.C. He has succeeded Dr. Henry Skinner who for more than twenty years guided the destiny of this well known Arboretum and who had developed it into one of the outstanding arboreta of this country. On January 3, 1973 Dr. Creech and the National Arboretum greeted each other officially and it is expected that he will fill this new post with energy, enthusiasm and a capacity for getting things done.

The National Arboretum is one of the show places of Washington D.C. Located on 412 acres in the heart of our Capitol, there are magnificent displays of azaleas, magnolias, dogwoods and other plants. It is not only a spectacular sight for the visitor but it is also a place for research and education. A staff of scientists conducts research on shrubs and trees and other staff members develop methods for informing the public on culture, propagation, and selection of better plants for gardens.

An eminent horticulturist as well as plant explorer, Dr. Creech as the new Director brings special talents. He is an acknowledged leader in the field of plant explorations for ornamentals, with emphasis on azaleas, camellias and magnolias. Before coming to the National Arboretum he was, at various times, horticulturist in charge of the U.S. Plant Introduction Station at Glendale, Maryland; chief of the New Crops Research Branch of the Agricultural Research Service and a staff scientist for ARS.

The story of Dr. Creech's prominence in the field of plant exploration began with his deep interest in the early explorers in the field, men like Fairchild, Wilson, Meyer, Forrest, Farrer, Kingdon-Ward and others. These men were drawn to China as though by an invisible magnet. The great snow ranges of Western China up from Burma and along the Yangtse River were focal points in their quest for rare

plant material. The period of their expeditions began around 1900 and continued until about 1930. This striking period has been described by Dr. Creech in an article written for ARNOLDIA, the Arnold Arboretum bulletin, entitled, "Plant Introduction-Building On Th Past." Here he has written a vital account of the early beginnings in plant exploration, replete with incidents of high adventure encounters with adversity, often with loss of valuable plants. Dr. Creech stated in his article, "Time does not allow for the discussion of the many plants obtained during the first thirty years of the 20th Century that survived the rigors of climate, war and depression, and acceptance, to become important nursery plants. These are well documented in horticultural literature. As for plant exploration an era was at an end. The romantic years of plant collection were now finished!"

Since 1947 when he first came to work for the United States Department of Agriculture, Dr. Creech has been associated with seven of the thirteen ornamental plant explorations conducted by the department in cooperation with the Longwood Gardens, Kennett Square, Pennsylvania. In the search for diverse types of ornamental species, Dr. Creech and his associates have been to Nepal, Taiwan and Yugoslavia and twice to the Soviet Union, including a recent trip to Siberia. Dr. Creech has been to Japan three times, regarding this country with special fondness. Moreover he has kept in touch with scientists in all of the countries visited. The program initiated by the Longwood Gardens and the Agriculture Research Service has been the most significant event in modern ornamental plant exploration. Public and private gardens here joined forces to meet the needs of the gardening public. The Longwood-ARS program concentrated on regions of the world where exchange of plants and seeds could not easily be accomplished. A thorough survey of botanic gardens in Europe was made for approved varieties not available to American horticulturists. Most recent of these explorations were to New Guinea in 1970 and to Siberia in 1971. Of this latter expedition, in a most interesting article written for the University of Washington ARBORETUM BULLETIN, Fall issue of 1972, entitled, "Plant Collector in Siberia," Dr. Creech reviewed his experiences in collecting Siberian plants and visiting institutions which were assembling Asiatic plants. He found the University of Moscow of special interest, as it featured plants on a geographical basis; Alpine flora; collections from the Steppes; plants from the far East; the Caucasus Region and the Crimea. He was offered seeds, cuttings and plants from all the major botanic gardens in Siberia. However he cautioned other visitors that it was difficult to get living plant material out of the USSR in good condition. Dr. Creech went on to say that he did not find Siberia in general an exciting collecting ground but a sufficient number of surprises made the journey worthwhile.

Now that he has left the field of exploration to direct a major arboretum, Dr. Creech was asked how he felt about this transition. How did it feel to leave the world of exploration into remote parts of the world for the relative confinement of an cffice and desk in the Arboretum? "It is like coming home," he said. "For a plant explorer being here is a vicarious pleasure." Then he went on to say that exploring is not entirely out of the picture and that given the chance he might well go on some expedition. At least he is keeping his options open! He continued his remarks, "I'm really not that far from plant exploration. When I walk around the grounds, which I do every day, I can see some of the wild ornamentals and shrubs that I've brought from the East."

Dr. Creech now looks ahead to continuing the basic plans for the National Arboretum that his predecessor, Dr. Skinner had so well begun. It is his opinion that Dr. Skinner had many dreams about developing the Arboretum and his own desire is to see these carried out. As he explains it, his ambition is to expand on the base already developed. He would like to see a garden and promenade for the elderly such as they have in Japan. He says that gardens for the blind and the handicapped are being considered to expand the Braille Trail already there. He cites the need for pollution-resistant trees and shrubs. He feels the research and educational phases need to be strengthened. There are busy years ahead

(continued on p. 22)

Photo: Dave Potts

SOME OF OUR FAVORITES
Won't You Send Us Yours?

Enkianthus campanulatus

*ED HUME**

One shrub that our entire family has taken great interest in is the colorful ***Enkianthus campanulatus.*** Recently, when we were in the process of moving from Edmonds to Lakewood, our neighbors expressed their sorrow in our moving, but let it be known that we couldn't possibly take the beautiful enkianthus with us. This was particularly interesting to me because I am sure none of them had ever seen or probably even heard of this shrub a few years ago; however, its beauty had won the favor of them all.

We cannot decide during which season this shrub is the prettiest. Certainly the brilliant scarlet autumn leaf color, with tinges of orange and yellow, is magnificent, but what about the bell-shaped spring flowers that resemble little parachutes . . . or the sleek lines of the plant in wintertime, when it is barren of leaves?

The specimen we have at home is about six

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*Mr. Hume, a new member of the Arboretum Foundation Board of Directors, is Garden Editor of the ***Seattle Post-Intelligencer,*** popular writer and lecturer for other northwest publications and radio and TV, and WSU Master Gardener.

feet high and spreads about seven feet. It is a prized plant with sentimental value because it was a gift from the late Paul Brown, a former superintendent of the Arboretum.

We have our *Enkianthus campanulatus* planted in a raised bed in full sun, and it thrives in such a location. However, it is also at home in semi-shade. Its uses in the garden are almost unlimited, plus it makes an excellent subject for containers on a deck, patio or near the entry area.

The tiered growth of the plant is emphasized by the clusters of leaves that appear toward the ends of the branches. Spring flowers appear in clusters and vary in color; they may be soft yellow, pinkish or light orange and they have faintly-visible striped red markings. Each flower is about half an inch long and is bell-shaped, hanging to resemble a miniature parachute. Being very attractive, the plant becomes quite a conversation piece when in bloom.

When enkianthus is young, the growth is rather upright. With age, it begins to spread, providing plants are not crowded together.

Enkianthus campanulatus is not really very fussy about soil, providing it is well-drained. A sandy loam type, with generous amounts of peat moss added, seems to be to its liking. Soil conditions similar to those preferred by rhododendrons are ideal. When fertilizing is required, a rhododendron type plant food should be used in early spring or after flowering is over in June.

Pruning should be kept to a minimum because it would be a shame to spoil the naturally irregular habit of growth. If lengthy sucker-like growth appears, it should only be pruned back to conform with the lines of the plant. Don't tell my wife, but the cut branches are very interesting in decorative flower arrangements.

If you don't already have an Enkianthus in your garden, I hope you will take time to observe this outstanding shrub on the grounds at the Arboretum. It would be a nice addition to almost any garden . . . and be sure to choose a spot for it where you can enjoy its many attributes throughout the year. ↑

(continued from p. 20)

for Dr. Creech in advancing the cultural, scientific and esthetic aspects of the National Arboretum. But the ease with which Dr. Creech deals with people, plus his immense energies and relaxed wit, make him friends everywhere. He is active in many national and international bodies, both as member and advisor.

As for hobbies he has one that obsesses him—horticulture! ↑

Conifers have many moods. In spring their young foliage is sometimes as fresh as anything that season can offer and the 'flowers' of a larch and of certain spruces and firs, such as *Picea likiangensis*, are in astonishing shades of red that are a delight to gardeners and flower arrangers alike. In summer, the glaucous-leaved types are at their most persuasive and the young cones of the firs (species of *Abies*) vary in colouring from pale ice, through dove and mauve to rich navy blue. In autumn we see many cones at maturity and the deciduous conifers take on bright tints before leaf-fall.

But in winter . . . their mood is quite different then, however, blue-leaved (glaucous) conifers reflect everything that is most chill and foggy, leaden and glum from the sulky skies and muffled distances so characteristic of the season. . . .

THE WELL-TEMPERED GARDEN, Christopher Lloyd
E. P. Dutton & Co., N.Y., 1971 (p. 370)

UNIT CONVERSATIONS

Education is "big business" for the Arboretum Foundation Unit Council! The 1973-74 calendar is filled with opportunities for every interest. Second Vice-Chairman Lee Clarke (Mrs. Fred G.) has been busy during the summer organizing that educational program for the coming year as well as providing opportunities for interested people to participate in cutting parties.

Mrs. Clarke announces that Miss Roberta Wightman, well known landscape architect, will present a series of five landscape design lectures titled "Your Garden From the Ground Up—or—Let's Do It Right the First Time!" Miss Wightman, in private practice in the Northwest since 1948, speaks from a background of wide experience as a graduate landscape architect, a founding member of the Washington Society of Landscape Architects, an instructor at Edmonds Community College, and a strong supporter of ecological and conversational principles long before the words "ecology" and "conservation" became popular in our everyday vocabulary. She will be remembered by some of our readers for her earlier work as a member of the Arboretum staff and for her work on the *ARBORETUM BULLETIN* as well as for her articles in that publication, the most recent one appearing in the Spring, 1972 issue, "Doing It Right the First Time." Her lecture-classes will discuss some of the landscape design principles and site preservations. For new gardeners she will stress problems of soil, drainage, arrangements of plant material suitable for patios, foundation plantings, and areas of use. For the more experienced gardener she will give advice on overplanting, pruning, correcting past mistakes, and planning for ease of maintenance.

The series of classes will be given at the Mercer Island United Church of Christ, 4545 Island Crest Way at 10:00 A.M. on the last Monday of the month—October 29, November 26, January 28, February 25, and March 25. A fee of $5.00 for the five lectures will be charged. To register phone the Foundation office—325-4510.

The Study Groups are another very popular facet of the Unit Council's education program. These groups meet monthly to study in detail specific plant material. Listed below are the groups, their meeting days, and the chairman of each group. For more information please call the number listed. New members are welcomed.

Rhododendron Study Group — First Monday
Marilyn Kolesar - 746-7280

House Plant Study Group — First Wednesday
Nancy Hewitt - 725-1909

Northwest Natives Study Group — October 23
Flo Steenrod - 232-0443

Vines Study Group — Third Tuesday
Joy Spurr - 723-8046

Rock Garden Study Group — Third Wednesday
Sue Peterson - 232-8046

The Arboretum Explorers is a different type of study group. They meet at the Arboretum office on the fourth Wednesday of each month. Those wishing to participate join Bob VanDenbergh for a guided two-hour tour of the Arboretum, viewing plant material especially lovely at that particular time.

PHYLLIS MORGAN

A Pacific-Northwest Chapter of the Holly Society of America was recently formed. Membership in the Chapter is open to anyone in Oregon, Washington, and British Columbia. This Chapter hopes to bring together those people who are interested in the genus *Ilex*, and to collect and disseminate information about holly, its culture and its many uses. Anyone interested in joining the new Chapter can contact one of the following people:

Mrs. R. E. Morell, 300 W. Wornet Bay Road, Oak Harbor, Wa. 98277

William F. Kosar, 2425 N.E. Seavy Circle, Corvallis, Ore. 97330

Book Reviews

FLORA OF THE PACIFIC NORTHWEST: An Illustrated Manual, C. Leo Hitchcock and Arthur Cronquist. (Textbook version—$19.50.) University of Washington Press, 1973. $25.00

THE FLORA OF THE PACIFIC NORTHWEST was published with the assistance of a grant from the University of Washington Arboretum Foundation through funds from the John Roderick Tolmie bequest.

The area covered by the book includes all of the State of Washington, the northern half of Oregon, Idaho north of the Snake River Plains, the mountainous part of Montana and an indefinite fringe of southern British Columbia.

This long-anticipated, one-volume flora is a useful and most welcome addition to any botanical library. Being a condensation of the previously published and more elaborate five-volume set, *THE VASCULAR PLANTS OF THE PACIFIC NORTHWEST*, this compact, 730-page book will serve as a quick and useful reference for students of the higher native plants.

Great effort has been made to compact the keys and illustrations into a volume of reasonable weight and attractive size. Beginning with the artificial key to the families, all plants included are illustrated. Especially helpful are the illustrations in connection with the keys to the families. Much of the description of each species is incorporated within the key that separates the specific members of a genus. For this reason it is well to trace the plant at hand through the key, running it both forward and backward to attain a full description of it. To make the best use of space the illustrations are placed on the left with the keys occupying the remaining two-thirds (approximately) to the right of the page.

The illustrations used in the *FLORA OF THE PACIFIC NORTHWEST* are reduced to one-half the size of those used in the five-volume set. Although some loss of detail resulted, the illustrations serve as a definite help in identification.

Dr. C. Leo Hitchcock, the senior author, is now professor emeritus of botany at the University of Washington, at Seattle, Washington. Dr. Arthur Cronquist is curator of the herbarium at the New York Botanical Garden, New York, N.Y. Jeanne R. Janish, a talented botanical artist made most of the illustrations used in the Flora of the Pacific Northwest.

CARL S. ENGLISH, JR.
Horticulturist,
Hiram M. Chittenden Locks
Seattle, Washington

THE POLLINATION OF FLOWERS, by M. Proctor & P. Yeo. William Collins Sons & Co. Ltd., London, Glasgow, Sydney, Auckland, Toronto, Johannesburg, 1973. 418 pp. 19 color photographs, 181 black and white photographs, and 134 line drawings. L4.00 net.

So far, 54 volumes have appeared in the British "New Naturalist" series. Some of these, such as C. T. Prime's book *LORDS AND LADIES*—which deals with Western Europe's wild arum lily, *Arum maculatum*—stand out as real gems; but the amazing thing about this series is that *in general* its books are so well-written, so beautifully produced, and so reasonably priced. Proctor and Yeo's new book on the pollination of British flowers lives up to the best traditions of the series; so much so that at this moment it is simply the best general book on pollination on the market. Not only are the two authors distinguished botanists, they also know their insects quite well — and this includes all those marvelous morphological adaptations, on the part of the flower-visiting animal, which can facilitate pollination. The authors write well. Also, it is obvious that they are quite familiar with the extensive German and French literature on flower pollination; the classical investigations of Knoll, von Frisch, Kugler, Dora Ilse, Pouyanne and many others are ably and fairly discussed and summarized. The list of references comprises about 500 items! The authors give credit where credit is due, and are quite accurate. It is clear that Proctor is an excellent photographer; many of the pictures in this richly illustrated book were taken by him. Finally: the book gives much more than we have a right to expect, for although the authors could have confined themselves to a discussion of British flowers and their pollinators, they have added a special 44-page chapter (No. 10) dealing with certain tropical flowers and with the pollination by birds and bats (which is not found in Europe). There is also an excellent historical introduction, a chapter on pollination in plant breeding and commerce, and one on the evolution and ecology of pollination. The final result is a book which is both delightful and thoroughly professional — a treasure-trove of information, which for many years to come will be used with pleasure and profit by professional and amateur biologists all over the globe.

There is very little to criticize in this book. Some German and French titles in the bibliography display misspellings (or printer's errors?). One can argue about the inclusion, in the book, of the contributions by certain authors, and the deletion of those made by other, equally meritorious, ones; however, to some extent such choices will always be a matter of taste. There are some terms for which one will look in vain in the index, such as "honey guide" and "nectar guide"; in the example chosen, this is to be deplored, since these expressions, although not correct for all cases, have found general acceptance. However, the word "guidemarks" does occur in the index, probably as a substitute. The only real omission in the book seems to be a thorough, separate discussion of timing-phenomena in plants, a topic which must be vitally important to anyone interested in the opening and closing of flowers (and, of course, to the pollinators too!) We concede, however, that dichogamy (a situation in which there is a considerable time-difference between the maturation of the pistil(s) and that of the stamens in one flower) is adequately discussed.

All in all, the imperfections in this book are trifling, and their number is quite small. This reviewer, for one, feels that the authors, with their loyal collaborators Avril Yeo and Jean Proctor and the various editors, are to be congratulated on a job splendidly

done. We are happy to recommend this book sincerely, wholeheartedly and without any significant reservation.

B. J. D. MEEUSE
Professor, Botany Department
University of Washington

GARDENING UNDER GLASS. An Illustrated Guide to the Greenhouse, by Jerome E. Eaton. Macmillan Co., N.Y., 1973, 306 pp. $8.95.

I find this book to be very concise, comprehensive and a perfect companion for anyone interested in greenhouse cultivation whether professional or hobbyist. Anyone interested in horticulture and its many facets would surely want to add this book to his library, the most practical gardening book I have ever had the pleasure to read. The coverage of the subject is thorough and up-to-date.

F. THURSTON WILLIAMS,
Horticulturist
Department of Parks and Recreation,
City of Seattle

HEATHS AND HEATHERS, by Terry L. Underhill. David & Charles, Newton Abbot, England, 1971. 240 pp. 1 color plate, 38 black and white plates, 41 maps and drawings. L2.50

In 1969, Mr. Frank Knight retired after 15 years as Director of the Royal Horticultural Society's garden at Wisley. Three years after his retirement in an article published in the *Journal of the Royal Horticultural Society* he wrote in detail of the procedures used in establishing a heather border for his new home. An accompanying illustration justifies Mr. Knight's approach to design; the plants, he says, "had the effect of producing a planting arrangement to fit the varieties given . . ." The border has color and interest throughout the year and is pleasing alike to the owners and to passers-by.

Mr. Knight's report typifies a current trend in Britain, where home gardeners wanting a kind of planting which gives all-year pictorial pleasure while being relatively undemanding in upkeep and expense, are increasingly finding great satisfaction and interest in their recently developed heather gardens. Perhaps this is partly because it brings a touch of their wild moorland into their daily view — a sentiment all of us in a crowded world can appreciate. Further evidence of this new interest is the burgeoning forth of The Heather Society from its initiation just ten years ago to currently well over a thousand members. Fifty of these members live in the United States and Canada, a start, at least, of what may become a healthy group of heather fanciers in North America.

In the Pacific Northwest, heathers have suffered by being easy to grow, with result that there has been too much unimaginative planting of an undiscriminating choice of plants, by gardeners with no remote idea of a moor. A fine guide to what *might* be done is *HEATHS AND HEATHERS*, by Terry L. Underhill. This is the most recent of a list of heather books which began with A. T. Johnson's little *THE HARDY HEATHS* in 1928. Fred Chapple's much more comprehensive *THE HEATHER GARDEN* followed, and its original and two revised editions were the mainstay of serious heather growers for 15 years or more. In 1966 appeared the charming *THE ENGLISH HEATHER GARDEN*, by D. Fyfe Maxwell and P. S. Patrick, which, among other things, was the first to show excellent line drawings of the species discussed. In the same year came John Letts' color illustrated handbook *HARD HEATHS AND THE HEATHER GARDEN.* Each of these books has taken its turn as a useful addition to the gardener's reference shelf, and each is to be recommended for its particular values. But it must be said that Mr. Underhill's book undoubtedly caps the lot.

Its chapter on the history and uses of these plants is surely exhaustive, mentioning everything from house-building and hedges to hurdles and honey. The chapter on planting and cultivation is sound, and commences with a very welcome discussion of soil requirements, going into considerable and enlightening detail on whys and wherefors. The description of a number of pests and diseases of heathers encountered in Britain and on the Continent is, most fortunately, up to now at least, of only academic interest in the Pacific Northwest, where heathers are remarkably pest-free.

Mr. Underhill has added a short chapter on heathers in the glasshouse, but he is not talking about hardy species, which do best with exposure to sun and wind. It is the South African Cape Heaths that are recommended for glasshouse growing. In the 19th Century this was a fashionable accomplishment — now seemingly having something of a comeback in Britain. The chapter on propagation is thorough and written from experience.

The welcome chapter on botanical characteristics and variations of heaths and heathers ends with a dichotomous key of some "hardy Erica species"; but several of those included are not hardy in the Pacific Northwest. This book is the first to include a standard botanical description and a geographical distribution map for each species, and has as well line drawings for each, and many very fine black-and-white photographs. It is good to see that this author has made an effort to find other words than just "pink" in describing all those subtle shades of purple-mauve-pink-red that are so hard to put a meaningful name to. The book is very well indexed. Finally, it is the volume which has the most up-to-date coverage of both old standbys and recent introductions among the Callunas, Ericas and Daboecias; though here it must be remembered that, as with other genera of great variety, the only way to keep informed of valuable and desirable cultivars appearing yearly is through the publications of the concerned specialty societies — in this case The Heather Society, which is now the international registration authority for these species, as well as Andromeda and Bruckenthalia. Mr. Underhill himself is Superintendent of Gardens at Dartington Hall, Devon, and an experienced and observant horticulturist.

We should not be human if we did not find some areas of disagreement in matters of judgment and opinion. My only real complaint with this book

is that in the section on cultivars the choice of type and lay-out makes it somewhat difficult to see quickly where one species ends and another begins. One supposes that this was done to save pages in the printing of the book. It is too bad that so very valuable a reference work wasn't allowed just that little extra stock to make it easy to find one's way around it in. The book is indispensable to anyone wanting the most comprehensive current heather information.

DOROTHY METHENY

INTERNATIONAL CHECKLIST OF CULTIVATED ILEX: Part I *Ilex opaca.* National Arboretum Contribution No. 2. Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. March 1973, price 70c.

For those of us dealing with cultivated plants and especially with the names of cultivated plants a "checklist" is an invaluable tool. Typically checklists will give in alphabetical order all the names of cultivars of the genus or species with which it is concerned.

The information about each cultivar may include the name of the person who named or introduced it and the date when and where it was published. Often there is a brief description of the plant, and any synonyms are cited. The list also includes invalid and doubtful names with the reason why they aren't accepted according to the *International Code of Cultivated Plants.*

The American holly, *Ilex opaca*, is not a plant widely grown in the Pacific Northwest where the English holly, *I. aquifolium* is so common, and because of this, Part I of the *International Checklist of Cultivated Ilex* will be of less interest to readers of this *Bulletin* than will forthcoming parts which should contain the correct nomenclature for many of those hollies which we grow so well.

The *Checklist* is divided into several parts — an introduction which explains why and how the lists were put together; an alphabetical list of the documented names which includes over 750 names both valid and invalid and short descriptions of most valid cultivars. There are three Appendices — one for names validated by being published for the first time in this list; one for names published previously but validated in this list; and a list of doubtful names.

In all, this appears to be a carefully done work that bodes well for future parts, especially that dealing with English holly, which will be of considerable interest to growers and gardeners alike in the Northwest.

J. A. WITT
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University of Washington Arboretum

A Northwest Heather Group is being formed for the purposes of enjoyment and sharing of information concerning heathers and their cultivation. Anyone who might be interested in joining the Group is invited to communicate with: Mrs. David Metheny, 2810 46th Avenue West, Seattle, Wa. 98199, 282-0818.

BULBS, A Complete Handbook of Bulbs, Corms and Tubers, by Roy Genders. Bobbs-Merrill Co., N.Y., 1973 (first published 1973 by Robert Hale & Co. London, 1973). 622 pp. 32 color illustrations, 44 line drawings and several black and white photographs. $19.95.

This book is very British in that it advocates a type of gardening which requires much work for the initial layout and for getting started as well as for maintenance later; during the growing season the duties involved may turn out to be rather cumbersome. The bulb-fancier who wants to put into practice some of the gardening techniques recommended here has to be a gentleman of leisure with a fair amount of time and money, and preferably a small army of helpers as well. Still, the book contains a vast amount of useful information upon which one could draw for interesting presentations in the realm of horticulture. The most fascinating chapter, in the eyes of the reviewer, is number one which discusses early history and subsequent progress and application of bulb plants in ornamental horticulture.

GERARD C. VREEBURG,
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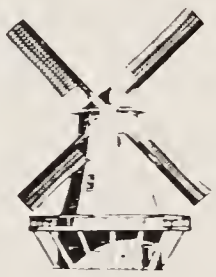

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November 15, 1973 — A HORTICULTURAL TOUR OF EUROPE IN THE SPRING OF '73

Mr. and Mrs. Brian Mulligan spent several weeks traveling through European gardens this spring. Mr. Mulligan will share with us some of their interesting adventures and show us their wonderful collection of colored slides.

February 21, 1974 — THE STORY OF THE EARLY DEVELOPMENT OF OUR OWN JAPANESE GARDEN

Mr. William Yorozu was the general contractor for the entire installation of the Japanese Garden at the University of Washington Arboretum.

May 16, 1974 — THE FASCINATING HOBBY OF VEGETABLE DYEING

Mrs. Joseph Witt will explain and demonstrate this interesting aspect of what to do with your vegetables besides cooking and eating them for dinner.

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